

until the 16th, when a very large and eleven small ones were found near east edge. The large one, estimated 31,360 miles in diameter, was on sun's meridian the 21st and disappeared by solar rotation 28th. The group of small spots was very changeable in appearance, nearly all vanished before reaching west edge. None seen after the 28th. Mr. C. E. Buzzell, Leaf River, Ogle Co., Ill.: clouds prevented solar observations 8th, 14th, and 15th. But one disturbance was observed during June, a large spot, followed by prominent faculae and a group of small variable spots, appeared by rotation on east limb 16th, passed meridian 21st, and west limb 27th. The group advanced perceptibly, while in view, and several spots were "merged." The larger one was about 22,000 miles in diameter,

and exhibited but very little variability. While this spot was passing the meridian on the 21st, there was a marked high electrical tension upon all the telegraph and telephone lines. There was also a severe disturbance on the 29th, during the storm which registered a maximum velocity of sixty miles from the east. Mr. M. A. Veeder, Lyons, Wayne Co., N. Y.: June 1st and 2d, numerous groups of faculae by rotation. This group of faculae occupied the entire sun's disc alone during the entire transit, disappearing by rotation on the 14th. A very large spot appeared by rotation 5.30 p. m., 15th; this spot was attended by many small ones. It began to divide into two parts on the 25th, and disappeared on the 27th. On the 27th, 28th, 29th, and 30th small groups of faculae appeared by rotation.

## VERIFICATIONS.

## FORECAST FOR 24 HOURS IN ADVANCE.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

The forecasts for districts east of the Rocky Mountains for April, 1889, were made by Captain James Allen, 3d Cavalry, Signal Officer and Assistant, and those for the Pacific Coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.

## Percentages of forecasts verified, April, 1889.

States.		States.	
Maine.....	81.2	Tennessee.....	81.3
New Hampshire.....	80.0	Kentucky.....	79.5
Vermont.....	75.9	Ohio.....	73.4
Massachusetts.....	80.9	West Virginia.....	72.4
Rhode Island.....	80.5	Indiana.....	82.0
Connecticut.....	80.4	Illinois.....	81.2
Eastern New York.....	79.9	Lower Michigan.....	78.7
Western New York.....	80.1	Upper Michigan.....	78.1
Eastern Pennsylvania.....	81.0	Wisconsin.....	81.9
Western Pennsylvania.....	78.1	Minnesota.....	76.1
New Jersey.....	81.2	Iowa.....	83.1
Delaware.....	75.0	Kansas.....	76.1
Maryland.....	71.4	Nebraska.....	77.9
District of Columbia.....	70.9	Missouri.....	80.5
Virginia.....	75.5	Colorado.....	78.7
North Carolina.....	75.7	Dakota.....	77.9
South Carolina.....	78.4	Southern California*.....	89.5
Georgia.....	78.9	Northern California*.....	84.9
Eastern Florida.....	87.7	Oregon*.....	78.8
Western Florida.....	92.3	Washington Territory*.....	79.7
Alabama.....	90.7	By elements: Weather.....	84.0
Mississippi.....	87.5	Temperature.....	73.3
Louisiana.....	81.7	Monthly percentage of weather and	
Texas.....	81.7	temperature combined †.....	79.7
Arkansas.....	79.1		

The forecasts for districts east of the Rocky Mountains for May, 1889, were made by Captain H. H. C. Dunwoody, 4th Artillery, Signal Officer and Assistant, and those for the Pacific Coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.

## Percentages of forecasts verified, May, 1889.

States.		States.	
Maine.....	74.5	Tennessee.....	90.3
New Hampshire.....	73.5	Kentucky.....	85.4
Vermont.....	80.8	Ohio.....	82.5
Massachusetts.....	83.2	West Virginia.....	85.5
Rhode Island.....	83.4	Indiana.....	80.0
Connecticut.....	82.9	Illinois.....	75.5
Eastern New York.....	79.7	Lower Michigan.....	79.7
Western New York.....	83.2	Upper Michigan.....	73.0
Eastern Pennsylvania.....	81.6	Wisconsin.....	73.3
Western Pennsylvania.....	83.4	Minnesota.....	79.4
New Jersey.....	82.6	Iowa.....	80.4
Delaware.....	85.2	Kansas.....	81.9
Maryland.....	82.7	Nebraska.....	82.6
District of Columbia.....	80.4	Missouri.....	81.0
Virginia.....	87.0	Colorado.....	79.9
North Carolina.....	89.7	Dakota.....	78.7
South Carolina.....	94.2	Southern California*.....	85.5
Georgia.....	92.8	Northern California*.....	78.1
Eastern Florida.....	92.8	Oregon*.....	83.6
Western Florida.....	93.9	Washington Territory*.....	79.7
Alabama.....	94.5	By elements: Weather.....	86.2
Mississippi.....	94.3	Temperature.....	80.0
Louisiana.....	88.9	Monthly percentage of weather and	
Texas.....	89.7	temperature combined †.....	83.7
Arkansas.....	88.4		

The forecasts for districts east of the Rocky Mountains for June, 1889, were made by Assistant Professor H. A. Hazen, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.

## Percentages of forecasts verified, June, 1889.

States.		States.	
Maine.....	74.5	Tennessee.....	72.0
New Hampshire.....	73.0	Kentucky.....	69.9
Vermont.....	72.1	Ohio.....	81.1
Massachusetts.....	77.2	West Virginia.....	72.1
Rhode Island.....	72.7	Indiana.....	77.6
Connecticut.....	75.1	Illinois.....	78.6
Eastern New York.....	71.7	Lower Michigan.....	76.9
Western New York.....	73.6	Upper Michigan.....	69.3
Eastern Pennsylvania.....	78.5	Wisconsin.....	77.3
Western Pennsylvania.....	75.9	Minnesota.....	75.3
New Jersey.....	74.7	Iowa.....	83.7
Delaware.....	75.2	Kansas.....	76.9
Maryland.....	81.1	Nebraska.....	79.9
District of Columbia.....	77.2	Missouri.....	78.1
Virginia.....	79.3	Colorado.....	76.9
North Carolina.....	80.7	Dakota.....	78.7
South Carolina.....	75.1	Southern California*.....	93.3
Georgia.....	75.4	Northern California*.....	90.2
Eastern Florida.....	81.9	Oregon*.....	88.2
Western Florida.....	82.1	Washington Territory*.....	87.7
Alabama.....	77.5	By elements: Weather.....	80.6
Mississippi.....	75.3	Temperature.....	70.6
Louisiana.....	79.1	Monthly percentage of weather and	
Texas.....	77.3	temperature combined †.....	76.6
Arkansas.....	75.4		

\* In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. † The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10.

Note.—Beginning with April 11, 1889, the verifications have been prepared by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams.

## CAUTIONARY SIGNALS FOR APRIL, 1889.

Statement showing percentages of justifications of wind signals and cold-wave signals for the month of April, 1889:

**Wind signals.**—(Ordered by Captain James Allen.) Total number of signals ordered, one hundred and twenty-eight; justified as to velocity, wholly, eighty-seven, partly, ten; justified as to direction, one hundred and twenty. Of the signals ordered, ninety-five were cautionary, of which sixty-two were wholly, and seven partly justified; thirty-three were storm signals, of which twenty-five were wholly, and three partly justified. Number of signals ordered for easterly winds, seventy-seven; justified, sixty-nine. Number of signals ordered for westerly winds, fifty-one; justified, fifty-one. Percentage of justifications, 74.6.

**Cold-wave signals.**—(Ordered by Assistant Prof. T. Russell.) Total number of signals ordered, seventy-one, of which forty-four were wholly, and three partly justified. Number of severe cold-waves without signals, six. Percentage of justifications, 63.5.

## CAUTIONARY SIGNALS FOR MAY, 1889.

Statement showing percentages of justifications of wind signals for the month of May, 1889:

**Wind signals.**—(Ordered by Captain H. H. C. Dunwoody.) Total number of signals ordered, one hundred and sixteen; justified as to velocity, wholly, eighty-seven, partly, eight;

justified as to direction, one hundred and ten. Of the signals ordered, one hundred and eight were cautionary, of which eighty-two were wholly and six partly justified; eight were storm signals, of which five were wholly and two partly justified. Fifty-eight signals were ordered for easterly winds, of which fifty-seven were justified; fifty-eight were ordered for westerly winds, of which fifty-three were justified. Percentage of justifications, 78.6.

No cold-wave signals were ordered during the month.

#### CAUTIONARY SIGNALS FOR JUNE, 1889.

Statement showing percentages of justifications of wind signals for the month of June, 1889:

*Wind signals.*—(Ordered by Assistant Professor H. A. Hazen.) Total number of signals ordered, forty-four; justified as to velocity, wholly, twenty-four, partly, two; justified as to direction, forty-three. All of the signals ordered were caution-

ary. Twenty-three of the signals were ordered for easterly winds, of which twenty-two were justified, and twenty-one were ordered for westerly winds, of which all were justified. Percentage of justifications, 57.1.

*Percentages of local verifications of weather and temperature signals as reported by directors of the various State Weather Services for June, 1889.*

States.	Weather.	Temperature.	States.	Weather.	Temperature.
Illinois.....	80.6	85.2	New Jersey.....	60.1	86.6
Kansas.....	83.4	85.7	New York.....	79.0	88.0
Kentucky.....	84.0	90.0	North Carolina.....	78.9	73.9
Michigan.....	85.7	83.1	Ohio.....	82.0	85.0
Minnesota.....	64.0	75.0	Pennsylvania.....	76.0	88.0
Nebraska.....	83.6	91.3	South Carolina.....	85.5	87.0

### STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts are republished from reports for June, 1889, of the directors of the various state weather services:

#### ALABAMA.

The average temperature for the month was 2.5 below the normal. This unusual depression was caused by the remarkably cool season the first few days of June. The thermometer ranged so low that some of the observers in the northern portions of the state reported the occurrence of slight frost.

The precipitation was slightly above the average, 0.29. Rains were frequent in north and west Alabama, while in eastern and southern portions of the state the farms suffered for rain until near the close of the month, when copious showers fell. Nearly one half the month was cloudy and there were few really bright, clear days.

##### SUMMARY.

*Temperature.*—Monthly mean, 75.7; highest monthly mean, 85, at Union Springs; lowest monthly mean, 70.2, at Valley Head; maximum, 101, at Wiggins, 18th; minimum, 36, at Valley Head, 1st; range for state, 65; greatest local monthly range, 53, at Wiggins; least local monthly range, 30, at Union Springs.

*Precipitation.*—Average for the state, 4.82; greatest, 8.91, at Elkmont; least, 1.06, at Citronelle.

*Wind.*—Prevailing direction, south.—*P. H. Mell, Signal Corps, Auburn, director.*

#### ARKANSAS.

##### SUMMARY.

*Temperature.*—Monthly mean, 74.1; highest monthly mean, 77.4, at Texarkana; lowest monthly mean, 69.8, at Dallas; maximum, 100, at Lead Hill, 19th and 20th; minimum, 42, at Paris, Tex., 1st; range for state, 58; greatest local monthly range, 52, at Paris, Tex.; least local monthly range, 28, at Marshall.

*Precipitation.*—Average for the state, 5.21; greatest, 9.48; least, 1.54, at Brinkley.—*Prof. John C. Branner, Little Rock, director; W. U. Simons, Sergeant, Signal Corps, assistant.*

#### COLORADO.

##### SUMMARY.

*Temperature.*—Monthly mean, 63.0; highest monthly mean, 71.5, at Mag-nolia; lowest monthly mean, 44.2, at Climax; maximum, 98.0, at Rocky Ford, 25th and 28th; minimum, 8.0, at Breckenridge, 10th; range for state, 90.0.

*Precipitation.*—Average for the state, 1.76; greatest, 5.10, at Cheyenne Wells; least, 0.14, at T. S. Ranch.—*Prof. F. H. Loud, Colorado Springs, director; T. W. Sherwood, Sergeant, Signal Corps, assistant.*

#### ILLINOIS.

##### SUMMARY.

*Temperature.*—Monthly mean, 67.2; maximum, 97, at Belvidere, 28th; minimum, 36, at Lake Forest, 1st; range for state, 61; mean of maximum, 90.6; mean of minimum, 44.4.

*Precipitation.*—Average for the state, 5.52; greatest monthly, 11.49, at Flora; least monthly, 1.50, at Sycamore.

*Wind.*—Prevailing direction, southwest.—*John Craig, Sergeant, Signal Corps, Springfield, in charge.*

#### INDIANA.

The month was cool; the mean temperature is the lowest for more than eighteen years, and it is about 5 below the normal for that period. The maximum occurred nearly everywhere on the 20th or 30th, and the lowest on the 1st.

The average precipitation is slightly above the normal, but the amounts were evenly distributed. All over the state rains were quite frequent, in fact to such an extent as to interfere with farm work.

##### SUMMARY.

*Temperature.*—Monthly mean, 67.9; highest monthly mean, 71.9, at Maringo; lowest monthly mean, 63.9, at Columbia City; maximum, 95, at Can-nelton, 20th; minimum, 39, at Mauzy, 1st; range for state, 56; greatest local monthly range, 54, at Mauzy; least local monthly range, 38 at Butlerville.

*Precipitation.*—Average for the state, 4.12; greatest, 7.32, at Delphi; least, 2.60, at Marion.

*Wind.*—Prevailing direction, southwest.—*Prof. H. A. Huston, La Fayette, director; C. F. R. Wappenhans, Sergeant, Signal Corps, assistant.*

#### IOWA WEATHER CROP BULLETIN SERVICE.

Both temperature and rainfall during the month were below the normal. The cool weather that prevailed during the first part of the month was succeeded by warmer weather, which, with the assistance of frequent and well-distributed showers, has advanced all crops to the standard for this time of the year. Frost occurred in some parts of the state on the 1st, causing considerable damage to tender vegetables, and retarding the growth of corn, but the high temperature during the latter part of the month has caused corn to recover rapidly, and it is now in splendid condition.

##### SUMMARY.

*Temperature.*—Monthly mean, 67.7; highest monthly mean, 72.6, at Wash-ington; lowest monthly mean, 64.0, at Cresco; maximum, 98, at Logan, 29th, and at Washington, 30th; minimum, 33, at Wesley, 1st; greatest local monthly range, 62, at Logan; least local monthly range, 25, at Gillet; range for state, 65.

*Precipitation.*—Average for the state, 4.68; greatest monthly, 9.87, at Logan; least monthly, 1.69, at Bancroft.—*G. M. Chappel, Sergeant, Signal Corps, Des Moines, in charge, Iowa Weather Crop Bulletin Service.*

#### KANSAS.

##### SUMMARY.

*Temperature.*—The mean temperature for the state is 71.2. In the eastern division 71.4, in the central 72.3, and in the western 70. There is a deficiency in temperature, amounting to 3 and upward, in the eastern division, but, diminishing westward, it falls slightly below 3 in the western division. Three cool waves passed over the state during June, centering about the 1st, 11th, and 22d. The range of temperature for the state is 67, being 3 greater than for June, 1887 and 1888. The maximum temperature, 107, is 2 less than June, 1887, and 13 higher than that of June, 1888.

*Precipitation.*—The average rainfall for the state, 4.01, is 0.05 greater than that of June, 1888, and 0.43 greater than that for June, 1887. The average rainfall in the western division for June, 1887, was 2.47; for 1888, 2.04; and for 1889, 3.35. In the middle division it was 3.59 in 1887, 3.04 in 1888, and 3.90 in 1889. In the eastern division, for June, 1887, it was 4.69; 1888, 5.44; while for 1889 it has dropped to 4.78. As regards the divisions of the state, the rainfall this year has been much more equable, but in each division the range is great. In the eastern division it ranges from 2.00 in the northeastern counties to 9.00 in Bourbon. In the central from less than 2.00 in Republic, Russell, and Rush to 5.00 and over in Mitchell, Osborne, Rooks, and Ellis, and 7.00 and over from Reno eastward. In the western from less than 1.00 in the southern parts of Trego and Gove to over 4.00 in Haskell, 5.00 in Gree-ley, and 10.00 in Rawlins. The rainfall is deficient from the Missouri River to Mitchell, and from the north line south to Franklin, Coffey, Lyon, and Chase; in Cherokee, Labette, Montgomery, and Chautauqua; and in Meade, Clark, Kiowa, and Pratt; and thence north to Russell, Ellis, Graham, and Sheridan. There is an excess from the southeast part of Reno to the east line of the state, being greatest in Bourbon. An excess occurs in the western and northwestern counties, culminating in Rawlins. A severe hail-storm